INTRODUCTION

Aerobiology starts from phytopathology which release of variable spores and ends with their deposition on surface. Them term came into existence during 1930 and collectively deals with airspora like air borne fungal spores, pollen grains and other micro-organisms. According to International Union of Biological Science, Aerobiology is defined as a scientific discipline focused on the transport of organism and biologically significant material by the atmosphere. The subject microbiology of atmosphere or aerobiology was established as a special branch of study by Meire et. al. (1933) of United States and Stepanov (1935) of U. S. S. R.

Jacobs (1951) has defined the term aerobiology as "it includes dispersion of insect population, fungal spores, bacteria, viruses, moulds and pollen having impact on all forms like both plants and animals that are borne high up and transported partly or wholly by the atmosphere." Aerobiology is the interdisciplinary science and is closely associated with phytogeography, biodeterioration, mailto-palynology, medicines, veterinary science and cosmos biology. For specific purpose an index such as the product of temperature and wetness duration is used to signify of potential infection period (Mills & Laplante, 1951). Gregory (1961) referred it as "The microbiology of atmosphere". The term is modified to include investigations of airborne materials of biological significance in the year 1964 with the inception of international biological programs (I.B.P.). According to Edmonds (1979) it is a scientific and multidisciplinary approach focused on the transport of organisms and biologically significant materials. A biotic particulates or gases affecting living organism are currently include in the concept of aerobiology (Nilsson, 1981).

While these established routines will continue to play an important role in the field of agrometerology, the wide spread use of aerobiology promises to improve the service (Pedgley-1982) provides a broad survey of airborne dispersal of plant pathogens, human allergens, livestock disease and pest insect and other organism. Aerobiological techniques have already been used successfully in some areas. According to one of the most recent definitions (I.A.A.) statutes & rules of procedures (1998), Aerobiology is the scientific discipline focused on the study of the passive transport of

organism and particles of biological origin in the atmosphere. Aerobiological techniques have already been used successfully in some areas. These include practices such as tracking the spread of foot & mouth disease. Traditionally it has never been concerned with birds & larger insects which can determine their own direction of height and are not carried passively the wind (Lacey-1994). Airborne fungi are considered to act indicator of the level of atmosphere bio-pollution. The presence of fungal spores, volatiles and mycotoxins in the air can cause health hazard in all segments of the population (Kakde et. al. 2001). Airborne fungal spores are ubiquitous in nature.

The micro flora of any habitat varies with host type environmental condition & relations among them. Thus the diversity of microflora differs from time to time & place to place. Air provides a natural habitat for microorganism like fungi, bacteria etc. The study of the bioparticles in the air is known as "Aerobiology." Aerobiology studies are of great importance as they provide with qualitative and quantitative information about airborne fungi in a particular region. Fungi are diverse group of organism and have been found in large amount in the environment. Aerobiology is a scientific discipline which deals with the studies of organism present in the air. Aerobiological investigations have been carried out with special reference to disease on crops, vegetable and fruits etc.

Biodeterioration of library materials is a worldwide problem and it causes great damage especially to unique manuscripts and books stored in the libraries. In this study we intend to discuss one of the biological factors as a main external group of factors that influence library materials. Fungal spores are an important component of the bioaerosol. The biological features of the fungi i.e. their case of dispersion makes fungi one of the chief agents of contamination of any type of substrate including cellulose materials in the books of library. Many are pathogenic to human beings causing allergic problems including asthma due to differential deposition in the respiratory system. These fungi along with bacteria are responsible for the deterioration of the materials in the library. The activity of different environmental factors may cause some changes in physical and chemical properties of library collections and most of the time it has been seen these conditions are conductive for the growth of microbes hence, accelerating the deterioration process. In addition to internal causes the deterioration of paper in books.

A BRIEF REVIEW OF THE WORKS ALREADY DONE IN THIS FIELD

Jacobs (1951) conducted aerobiology in compendium of metrology. Santra and Chanda (1981) study of indoor air borne fungal spore flora of Calcutta, West Bengal. Desmukh and Shukla (1984) studied thermophilic fungi in the air spora at Sagar. (M. P.). Kowalik (1984) conducted study of microbiodeterioration of library materials. Micro decomposition of auxiliary materials.

Tilak and Saibaba (1985) studied indoor aerobiology. Vittal and Glory (1985) studied airborne fungus spora of a library in India. Charkraverty and Sinha (1985) conducted study of the incidence *Aspergillus parasiticus* in the indoor and outdoor environment of Calcutta, India. Verma and Khare (1987) studied air spora around Jabalpur University campus. Vittal and Krishanmurti (1988) study of a census of the airborne molds spores in the city of Madras, India. Shukla *et. at.* (1989) studied incidence of air borne fungal spores in library at Bhopal. Santra and Chanda (1989) study of air borne fungal flora in indoor environment of the Calcutta metropolis. India.

Pandey and Tiwari (1991) studied aeromycoflora of Raipur. Panda and Behera (1991) study of seasonal incidence and succession of fungal spores in air after rain fall. Jadhav and Tiwari (1994) conducted study of aeromycoflora at Ravan village. Channy and Verma (1994) conducted study of incidence of airborne fungal spores in Jabalpur city using a volumetric spore's trap to assess the air quality of an indoor environment. Tiwari and Sahu (1994) studied Survey of airborne fungi at Raipur.

Burge (1995) studied Aerobiology of the indoor environment. Kumar P. L. (1995). Protection of documents from photo chemical effects of light CCIP New Delhi. Tiwari and Sahu (1995) studied aerobiological flora in Raipur. Uniyal (1995) studied prevention conservation of archival materials, some rather ignored but vital aspects New Delhi. Nayak and Behera (1996) study of seasonal and diurnal prevalence of airborne fungal spore over Berhampur University Campus of Orissa. Katial *et. al.* (1997) studied atmospheric mold spore counts in relation to meteorological parameters.

Tilak and Vishwe (1997) studied microbial content of air inside library. Krake *et. al.* (1999) studied evaluation in microbiological contamination in a museum. Chakraborty *et. al.* (2000) studied indoor and outdoor aerobiological survey in Burdwan, West Bengal. Kakde *et. al.* (2001) seasonal variation of fungal propagules in fruit market environment Nagpur (India). Bhattacharya *et. al.* (2001) study of measuring indoor fungal contamination in rural area West Bengal, with reference to allergy symptoms. Khilare and Chitnavis (2002) studied an Aeromycological survey of slum and decent areas of Kolhapur (M. S.). Asan *et. al.* (2002) studied airborne fungal in urban air of Edirne city (Turkey). Brave and Thakre (2003) studied biodeterioration of painting by fungi. Khandelwal (2003) sampling and estimate of fungal biodeteriogens of Lucknow, India. Nazaroff (2004) study of indoor particle dynamics.

Tiwari *et. al.* (2005) studied aeromycflora of Dairy area at Raipur (C. G.). Majumdar and Barui (2005) observed intramural aeromycoflora of residential house in Kolkata, West Bengal. Tiwari *et. al.* (2006) studied aeromycoflora of slum area at Raipur (C. G.). Gaylarde *et. al.* (2006) studied microbial impact on building materials an overview, material and structure.

Grover *et. al.* (2007) studied response of fungi community in the unpolluted and polluted habitats. Roymon *et. al.* (2007) studied air born microbes in college canteen atmosphere. Majumdar (2007) studied an assessment of the indoor mycoflora of school buildings in Kolkata. Roymon *et .al.* (2007) studied indoor air microbiological assessment of Cinema hall, Hospital, and Shopping center. Kalkar and Tatte (2007) surveyed aeromycological indoor environment in Hospitals. Roymon *et. al.* (2007) studied identification of some commonly occurring fungi isolated from indoor air samples of common public place.

Singh and Siddiqui (2009) studied a comparative aeromycological unpolluted and polluted air localities. Panda *et. al.* (2009) studied seasonal incidence of air borne fungi in coastal belt of Orissa. Sharma (2009) studied incidence of fungal allerges in the air at Raipur. Oliveira *et. al.* (2009) aeromycological profile of indoor and outdoor environment. Jadhav and Lall (2009) ecological studied of indoor aeromycoflora of Dr. Bhim Rao Ambedkar hospital, Raipur.

Sharma and Shaista (2010) studied the occurrence of mycoflora around dam area. Bhattacharya *et. al.* (2010) studied comparative aeromycoflora of two libraries. Pinzari *et. al.* (2010) studied measurement of the fungal deteriorating potential in the dust of indoor environments. Kotwal *et. al.* (2010) studied aeromycoflora of outdoor and indoor air of residential area of Nasik. Kulkarni (2011) studied aeromycological profile of the public parks of Bhilai Township (C. G.) India. Dalal *et. al.* (2011) studied incidence of deteriorating fungi in the air inside the college libraries at Wardha city.

Shukla, S. and Shukla, R.V. (2011) airborne fungal spores in the atmosphere of industrial town Korba-Chhattisgarh, India. Ghosh *et al.* (2011) studied identification and distribution of aeromycoflora in the indoor environment of Shyambazar metro-railway station, Kolkata, India.. Madhavi *et. al.* 2011 studied scholars research library. Nayak and Nanda (2011) studied comparative incidence and seasonality of airborne fungi in a library environment with meteorological effect.

Nafis and Sharma (2012) isolated aeromycoflora in the indoor environment of Chawri Bazar metro-railway station, Delhi, India. Sharma (2012) studied seasonal variation and ecological study of fungi in relation to biodeterioration. Gupta and Sharma (2012) studied the role of fungi in biodeterioration of sandstone with reference to Mahadev Temple, Bastar (C. G.). Gawri *et. al.* (2012) surveyed microflora present in dental caries and its relation to environment factors.

Adams *et. al.* (2013) studied dispersal of microbial fungi in indoor air are dominated by outdoor air and show dispersal limitation at short distance. Anand and Chowdhary (2013) studied first report on five hitherto unreported macro fungi from Rajouri district of Jammu Kashmir (J. & K.), India. Luka *et. al.* (2013) studied seasonal variation of aeromycoflora of Chhattisgarh institute of medical science (CIMS), Bilaspur, C. G. (India).

OUT LINE OF WORKING PLAN

Objectives:-

The plans of work for present investigation are as follows:

1. Survey and identification of aeromycoflora of library
2. Ecological study of aeromycoflora with special reference to percentage frequency and percentage abundance
3. Seasonal variation of aeromycoflora
4. Result and discussion

NOTEWORTHY CONTRIBUTION IN THE FIELD OF PROPOSED WORK -

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Wessele (1970) studied deterioration band preservation of library materials, the University of Chicago Press, Chicago. Tripathi (1987) studied fungal air spores inside central library of Gorakhpur University. Tilak and Pillai (1988) conducted aerobiological survey of fungi in library. Vittal *et. al.* (1985) studied airborne fungus spores of a library in India. Chamberlain (1991) worked on a new approach to treat fungus in small libraries. Bokhare, N. (1997) observed conservation of manuscripts Preservation is better than cure- conservation of cultural properties in India.

Ghani *et. al.* (1993) studied occurrence and composition of aeromycoflora outside and inside the college library and their correlation with meteorological data at Bhagalpur, India. Panday (Tiwari) and Tiwari (1994) studied aeromycoflora in library. Singh *et. al.* (1995) observed fungal spore as an important component of library air. Nadimadhu and Vittal (1995) studied volumetric survey of culturable molds in library environment. Jain *et. al.* (1997) studied certain paper deteriorating fungi in the library at

Gwalior. Zaska (1997) studied fungi isolated from library materials. Mahajan (1999) studied incidence biodeteriogens in the atmosphere of working library Visakhapatnum. Lugauskas and Krikstaponis (2004) studied microscopic fungi found in the libraries of villnius and factors affecting their development. Shamsian *et. al.* (2006) studied fungal contaminations in historical manuscripts at Astan Quds Museum library, Mushhad, Iran. Kumar *et. al.* (2007) worked on various aerobiopollutants by using petri plate exposer method inside a library.

Katarzyna *et. al.* (2008) studied microbiological contamination with moulds in working environment in libraries and archive storage facilities. Zotti *et.al.* (2008) studied microfungal biodeterioration of historical paper preliminary FIIR and microbiological analysis. Nayak and Nanda (2009) studied airborne fungal spores of a college library in an industrial city of Tamilnadu. Kumar *et. al.* (2009) observed preservation of library materials problems and perspective.

Bankole (2010) studied a review of biological deterioration of library materials and possible control strategies in the topics. Kumari *et. al.* (2011) observed comparative aeromycospora in different localities of Gorakhpur (U. P.). Chadeganipour *et. al.* (2011) studied bio-deterioration of library materials: study of fungi treating printed materials of libraries in Isfahan University of medical science. Devi (2013) studied aeromycoflora of a college library in Imphal.

PROPOSED METHODOLOGY

The air spora of indoor environment is studied by culture plate exposure method. Survey of aeromycoflora at different heights from the Pt. Ravishunkar Shukal university Raipur library is carried out at forthrightly intervals by using exposed five culture plate. The culture plate method is used for determination of total number of colonies recorded in the entire sampling period. Containing Potato Dextrose Agar (PDA) media are exposed for 10 min. and then incubated at 28±1◦c for 4-5 days and regularly examined. After incubation period the colonies are isolated, counted, identified and classified on the basis of their characters with the help of authentic and available literature. It was observed that the deteriorating activity of fungi changed with respect to paper type. Fungal species will be sent to the Division of Mycology and Plant Pathology, Indian Agriculture Research Institute, New Delhi for identification.

For ecological studies, at the end of incubation period percentage frequency and percentage abundance species is assessed by the following formula (Jadhav and Tiwari 1994).

$$\text{Percentage Frequency} = \frac{\text{No. of observations in which a species appeared}}{\text{Total Number of observations}} \times 100$$

$$\text{Percentage Abundance} = \frac{\text{Total No. of colonies of a species in all the observation taken together}}{\text{Total Number of colonies}} \times 100$$

The quality and quantity of fungal spores vary in different seasons therefore it is essential to study the air spora in different seasons. Much attention is now being given to the air spora in investigations as pattern of distribution of fungal spores is different in different seasons. Qualitative and quantitative analysis of fungal spores of the library atmosphere have helped in deterioration of library materials.

EXPECTED OUTCOME OF THE PROPOSED WORK

Fungi, a specialized group of microorganism are dangerous agents inside library which are not only responsible for paper deterioration and ageing of book in the library but also significantly affect health of the library staff. The deterioration of library material by microorganism has attracted attention in recent years. Efforts have been made towards reduction of these losses by finding out the condition, causes and weather conditions, which incidentally contribute to the deterioration of library books and other materials.

Libraries are the knowledge banks having tremendous collection of books. Books are made up of paper i.e. cellulose and hence can be easily degraded by microorganism including fungi. Fungi play important role in deteriorating of books. Books in the library contain number of thoughts given by the Scientists, Thinkers, Psychologists, and Journalists about different methods and subjects which are beneficial to coming generations. Study and preservation of books is also essential and obligatory to promote knowledge for a bright future. Efforts have been made since long back to prevent the books from the harmful effects of fungi and provide them a longer life.

By studying about the harmful fungus (aeromycoflora) present in the air of library we can save the library materials by using safety precautions and also apply it for better health of workers working in that place. Fungal activities, various methods of disinfection such as chemical methods and radiation should be considered for elimination of contaminating fungi.

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